ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE MATERIAL

COURSDE NAME: AUGMENTED REALITY

Augmented reality (AR) is the real-time use of information in the form of text, graphics, audio and other virtual enhancements integrated with real-world objects. It is this "real world" element that differentiates AR from virtual reality. AR integrates and adds value to the user's interaction with the real world, versus a simulation.

The primary value of augmented reality is the manner in which components of the digital world blend into a person's perception of the real world, not as a simple display of data, but through the integration of immersive sensations, which are perceived as natural parts of an environment. The earliest functional AR systems that provided immersive mixed reality experiences for users were invented in the early 1990s, starting with the Virtual Fixtures system developed at the U.S. Air Force's Armstrong Laboratory in 1992.

Augmented reality is used to enhance natural environments or situations and offer perceptually enriched experiences. With the help of advanced AR technologies (e.g. adding computer vision, incorporating AR cameras into smartphone applications and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulated. Information about the environment and its objects is overlaid on the real world. This information can be virtual. Augmented Reality is any experience which is artificial and which adds to the already existing reality.

Top AR use cases

AR can be used in the following ways:

- **Retail.** Consumers can use a store's online app to see how products, such as furniture, will look in their own homes before buying.

- **Entertainment and gaming.** AR can be used to overlay a virtual game in the real world or enable users to animate their faces in different and creative ways on social media.
- **Navigation.** AR can be used to overlay a route to the user's destination over a live view of a road. AR used for navigation can also display information about local businesses in the user's immediate surroundings.
- **Tools and measurement.** Mobile devices can use AR to measure different 3D points in the user's environment.
- **Architecture.** AR can help architects visualize a building project.
- **Military.** Data can be displayed on a vehicle's windshield that indicates destination directions, distances, weather and road conditions.
- **Archaeology.** AR has aided archaeological research by helping archeologists reconstruct sites. 3D models help museum visitors and future archeologists experience an excavation site as if they were there.

Examples of AR

Examples of AR include the following:

- **Target app.** The Target retail app feature called See it in Your Space enables users to take a photo of a space in their home and digitally view an object, like a picture on the wall or a chair, to see how it will look there.
- **Apple Measure app.** The Measure app on Apple iOS acts like a tape measure by enabling users to select two or more points in their environment and measure the distance between them.
- **Snapchat.** Snapchat filters use AR to overlay a filter or mask over the user's Snap or picture.

- **Pokemon Go.** Pokemon Go is a popular mobile AR game that uses the player's GPS to detect where Pokemon creatures appear in the user's surrounding environment for them to catch.
- **Google Glass.** Google Glass is Google's first commercial attempt at a glasses-based AR system. This small wearable computer enables users to work hands-free. Companies such as DHL and DB Schenker use Google Glass and third-party software to enable frontline workers to be more efficient when it comes to global supply chain logistics and customized shipping. Google is also working on another pair of glasses in 2022 that's designed to overlay a live transcription or translation of what another person says in text.
- **U.S. Army.** The U.S. Army uses AR in an eyepiece called Tactical Augmented Reality (TAR). TAR mounts onto the soldier's helmet and aids in locating another soldier's position.

Future of AR technology

AR technology continues to grow as the popularity and familiarization of apps and games like Pokemon Go or retail store AR apps increase. The expansion of 5G networks may make it easier to support cloud-based augmented reality experiences, for example, by providing AR applications with higher data speeds and lower latency.

Apple continues to develop and update its open source mobile augmented reality development tool set, ARKit. Companies, including Target and Ikea, use ARKit in their flagship AR shopping apps for iPhone and iPad. ARKit 6 enables users to render AR in 4K high-dynamic range, or HDR, and improves image and video capture. ARKit 6 also provides a Depth API, which uses per-pixel depth information to enable a device's camera to understand the size and shape of an object and includes scene geometry that creates a topological map of a space along with other improvements.

The Android equivalent of ARKit, ARCore, also continues to grow and improve. For example, ARCore uses a geospatial API that sources data from Google Earth 3D models and Street View image data from Google Maps. Similar to ARKit's Depth API, ARCore has improved its Depth API, optimizing it for longer-range depth sensing.

Modern advances under development, such as Google's smart glasses that live translate audio to text, will revolutionize how people who speak different languages communicate. Because AR uses immersive technology, more opportunities and experiences across different platforms and media types are on the horizon.

Types Of AR

Augmented reality is of four types: Marker-less, Marker-based, Projection-based, and Superimposition-based AR. Let us see them one by one in detail.

1) Marker-based AR

A marker, which is a special visual object like a special sign or anything, and a camera are used to initiate the 3D digital animations. The system will calculate the orientation and position of the market to position the content effectively.

2) Marker-less AR

It is used in events, business, and navigation apps, **for instance,** the technology uses location-based information to determine what content the user gets or finds in a certain area. It may use GPS, compasses, gyroscopes, and accelerometers as can be used on mobile phones.

3) Project-based AR

This kind uses synthetic light projected on the physical surfaces to detect the interaction of the user with the surfaces. It is used on holograms like in Star Wars and other sci-fi movies.

4) Superimposition-based AR

In this case, the original item is replaced with an augmentation, fully or partially. The below example is allowing users to place a virtual furniture item over a room image with a scale on the IKEA Catalog app.

Augmented reality is the technology that expands our physical world, adding layers of digital information onto it. Unlike Virtual Reality (VR), AR does not create the whole artificial environments to replace real with a virtual one. AR appears in direct view of an existing environment and adds sounds, videos, graphics to it.

A view of the physical real-world environment with superimposed computer-generated images, thus changing the perception of reality, is the AR.

The term itself was coined back in 1990, and one of the first commercial uses were in television and military. With the rise of the Internet and smartphones, AR rolled out its second wave and nowadays is mostly related to the interactive concept. 3D models are directly projected onto physical things or fused together in real-time, various augmented reality apps impact our habits, social life, and the entertainment industry.

AR apps typically connect digital animation to a special ‘marker’, or with the help of GPS in phones pinpoint the location. Augmentation is happening in real time and within the context of the environment, for example, overlaying scores to a live feed sport events.